



Inexact hardware for modelling weather & climate

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The use of stochastic processing hardware and low precision arithmetic in atmospheric models is investigated. Stochastic processors allow hardware-induced faults in calculations, sacrificing exact calculations in exchange for improvements in performance and potentially accuracy and a reduction in power consumption. A similar trade-off is achieved using low precision arithmetic, with improvements in computation and communication speed and savings in storage and memory requirements. As high-performance computing becomes more massively parallel and power intensive, these two approaches may be important stepping stones in the pursuit of global cloud resolving atmospheric modelling.

The impact of both, hardware induced faults and low precision arithmetic is tested in the dynamical core of a global atmosphere model. Our simulations show that both approaches to inexact calculations do not substantially affect the quality of the model simulations, provided they are restricted to act only on smaller scales. This suggests that inexact calculations at the small scale could reduce computation and power costs without adversely affecting the quality of the simulations.